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THE CONSERVATION AND PROPER UTILIZATION OF OUR NATURAL RESOURCES[1]

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THE natural resources of the United States are the richest and most varied of any country in the world. It is only necessary to call attention to our great coal and oil fields and natural gas, our varied mineral resources, wonderful forests of hard and soft woods, our multitude of species of wild game mammals and birds and fur-bearing animals, the hundreds of species of useful insectivorous and predaceous birds, and the rich fisheries of our Atlantic, Gulf and Pacific coasts, Great Lakes and other interior waters, to enable us to realize that our country has been exceedingly blessed in this regard.

And this very richness of natural resources has had much to do with making us the most short-sighted, the most extravagant and the most wasteful people in all the world. There is not one of our natural resources which, in the beginning of the development of the country, was not handled in very wasteful ways; in numerous instances so wasteful and destructive that the resource was wiped out almost, if not quite, entirely. Such were the Buffalo, Wild Pigeon, Atlantic Salmon, Wild Turkey, Gray Squirrel, Sturgeon, Sea Otter, natural gas, white pine and many others that might be mentioned.

It is now too late to do anything to correct the mistakes with some of the species that were once valuable assets to our people, because they are now entirely extinct, or are species whose well-being depends upon an environment which has passed and can not be restored. But there are many species of the native flora and fauna with which it is not too late and which, with proper care, can again be restored to something like their former abundance and usefulness.

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[1] Presidential address delivered June 22, 1922, at the Salt Lake City meeting of the American Association for the Advancement of Science.

The Forests

It was my good fortune to be brought up in the middle Wabash Basin, a region in which was then found perhaps the greatest hardwood forest the world has ever seen. Great oaks, hickories and elms, each of several species, magnificent sycamores, black walnuts, yellow poplars or tulip trees, splendid gray ash and swamp ash, three or more species of maples or sugar-trees, poplars or cottonwoods of half a dozen species, some of them magnificent trees, and, scarcely less in size and value, but not at all in interest and beauty, were many others that might be named if time permitted. No other forest so rich in species and individuals of commercially important and esthetically interesting trees has ever existed elsewhere in the world. And the pity of it all is that the pioneers of those days never realized what a wonderful asset they had in their great forests. They regarded the forest simply as a source of supply for firewood and the small amount of logs and lumber they needed for buildings, fences and the like, and as something that must be got rid of as soon as possible in the interests of agricultural development.

I have seen many a barn built largely, if not wholly, of black walnut logs; and I later saw some of those same barns and stables torn down and the walnut logs hauled away to the sawmill to be converted into high-priced lumber. On my own father's farm and on many others in the same county, there were thousands of walnut rails in the Virginia worm fences with which the farms and fields of those days were enclosed. In the early seventies, black walnut became so valuable that even the stumps were dug out and shipped away to furniture manufacturers.

The wastefulness in clearing the land was almost beyond belief. Little or no effort was made to save any of the timber except that needed for immediate use. When a piece of land was to be cleared, all the trees were first girdled thus creating a deadening. Then the trees of whatever kind were felled or burnt down, after which the trunks were cut or burnt ("niggered off") into logs of lengths for convenient handling. With teams of horses or oxen, these logs were then snaked around and piled into great log-heaps, four logs on the ground constituting the bottom layer, three on top of these, two on top of them, and finally one at the top. Each log-heap would thus consist of 10 logs, with small limbs, chunks and trash filling the interstices to serve as kindling when the heaps were to be burned. So heavy and dense was the forest that there would be scores of these great heaps on every acre, each heap made up of logs of the very finest quality whose value to-day would be many times that of the land on which they grew.

The bringing of the land under cultivation was essential to the development of the country. This, of course, necessitated the removal of the forest; heavy forests and corn-fields can not thrive on the same ground at the same time. Nevertheless, the methods were most wasteful, but a valuable lesson can be learned therefrom. Many of the important forestry and agricultural problems that confront us to-day could have been avoided or never would have arisen, if the pioneers could have foreseen the results of their wasteful methods.

That there are many very serious problems is well known to every one who has given the matter any attention. According to the U. S. Forest Service, three fifths of our primeval forests are gone, and the timber remaining is being consumed four times faster than it is being replaced. Several of our principal forest regions are already completely exhausted as large producers of wood products. The injury is felt through the process of regional exhaustion, compelling recourse to more distant and less accessible regions, with the inevitable increase in cost of production, higher freight rates, and greater cost to the consumer.

While the depletion of our forests for legitimate ends has been great, it is the devastation of the forests that has been most serious. The Forest Service tells us there are 326 millions acres of cut over timberlands in the United States. On 81 million acres there is practically no forest growth, and this is the result of forest fires and methods of cutting which destroy or prevent new timber growth. There were in 1919, 27,000 recorded forest fires which burned over 8 million acres. A large additional acreage is burned each year of which there is no record. The area of idle land is being increased 3 to 4 million acres annually as the cutting and the burning of the forests continue. The Forest Service estimates the forest land in the United States not required for any other economic use at 463 million acres, an area that would provide an ample supply of wood if kept productive. Depletion has resulted not from using our timber resources, but from a failure to use our timber-growing lands. The real solution of the timber problem is to grow new forests on the cut-over and the burnt-over ground and protect the forests we still have. There must be a concerted effort on the part of the Federal Government, the states and private owners to stop the devastation of our remaining forests and to put our idle forest lands at work growing timber. As the Forest Service well says, it is inconceivable that we should go on using up our forests without making provision for growing new to replace the old. The policy should be to maintain timber production on somewhat the same footing as in Scandinavia and France; this should become an established national policy and practice.

The national forests contain several million acres of forest land so severely burned over that it can not be restored without replanting. To restore this land to timber production is an immediate Federal responsibility. Tree-planting is most urgent on denuded watersheds from which water is obtained for power, irrigation, or municipal use.

The cutting off of the forests, but more particularly the undergrowth, has been far-reaching in its disastrous results. The effect upon the animal life of the forests themselves has been marked indeed. Many species of mammals, birds, reptiles and amphibians that found a congenial home in the heavy forests of Indiana and other upper Mississippi Valley states 50 years ago are now rarely or never seen; many of them are now extinct in those regions. Many species have disappeared not because of overhunting but chiefly because of the destruction of the forest cover which was essential to their protection from their various enemies and to their habits of life.

Another deplorable result is that upon the streams of the country. While the removal of the forest cover has probably had no appreciable effect upon the rainfall, it has had a very decided effect upon the run-off. With the forest cover the rain was held by the underbrush until much of it soaked into the ground and the run-off was slow and gradual. The streams therefore had a relatively even flow throughout the year. Now, with the forest cover gone and the land under cultivation, the run-off is rapid, and the streams are very uneven in their volume; raging torrents at times, often spreading beyond the banks after heavy rains, and in the dryer season reduced to series of stagnant pools. And what a change in the beauty of the stream! Then a beautiful, stately flowing stream of clear, cool, pure water, the banks heavily wooded and with underbrush of many interesting shrubs, and greensward here and there, and the water teeming with fishes of many kinds; now at times merely a sluggish, weed-choked thing as devoid of beauty as it is of fish.

Fortunately, it is still possible greatly to improve these streams and bring them back to something of the beauty of earlier days. This can be done by reserving from cultivation a narrow strip of ground along each side of the stream and planting it with perennial plants, shrubs, bushes, vines and trees that will hold the immediate banks of the stream in place and at the same time check the run-off, conserve the moisture, shade the stream, and increase the beauty of the stream amazingly. This strip can be any width, the wider the better of course, but it ought to be at least 30 yards.

A little attention of this kind will greatly increase the stability and beauty of the stream; it will also be helpful to the fish life of the stream by giving the fish more protection, shade and food. It will be of benefit to the farmers and others along the stream in that it will protect their land from overflow and from destructive erosion.

Another regrettable result of the cutting of the forest and the undergrowth and the draining of the marshlands and the small woodland ponds, is the extermination of many species of the native flora. Among such species that were formerly more or less abundant in the upper Mississippi Valley that may be mentioned are the Wild Red Plum (*Prunus americana*), the Wild Cherry (*Prunus serotina*), Black Haw (*Viburnum prunifolium*), Red Haw (*Cratœgus pyrifolia*), Pawpaw (*Asimina triloba*), Leatherwood (*Dirca palustris*), Kentucky Coffee-tree (*Gymnocladus canadensis*), Spice-bush (*Benzoin œstivale*), and various species of orchids, particularly the showy Ladies'-Slipper (*Cypripedium reginœ*). These interesting and beautiful species that added so much of grace and beauty and charm to the virgin forest are now rare indeed, and in some localities entirely extinct. And the regret is all the greater because of the fact that every one of them could have been preserved in considerable abundance if only a little foresight and care had been shown.

EFFECT OF DEFORESTATION UPON THE FISHES OF OUR STREAMS

The effect upon the streams of the cutting away of the forests has been very great, as already pointed out, and it has been equally great upon the fishes of the streams. In order that a stream may support a large and varied fish-fauna it must be somewhat uniform and constant in its character. A stream which at one time is a raging torrent and at another season a series of isolated stagnant pools, does not permit the development and maintenance of a fish-fauna rich in species or individuals. This fact may be readily appreciated if we compare a typical Mississippi Valley creek or river with any typical stream in California where all the streams are subject to great extremes. In almost any small stream in Indiana, there may be found not fewer than 30 to 40 kinds of fishes, a greater number than occurs in all the streams of California or Utah. But the Mississippi Valley streams are rapidly becoming in this respect like those of California—streams of unstable and extreme conditions, and fish-life is decreasing correspondingly. The food and game species, of which there were a score or more originally, are now very scarce. Some of them have entirely disappeared, while others are so rare as to afford little or no sport for the angler.

The United States Forest Service and the National Parks Service in their administration of the National Forests and the National Parks respectively are to-day the most efficient and most effective forces working for the conservation of the forests, the water supply and the natural scenic and esthetic beauty of our country. However, the tendency of the National Parks Service to graft on to some of the National Parks various Coney Island alleged attractions is deplored. National parks should be maintained as *natural* parks and not be marred by artificiality of any avoidable kind.

DRAINAGE OF SWAMPS, PONDS AND LAKES

Not until recently have we come to realize that the drainage of swamp-lands, marshes, ponds and small lakes may be fraught with great danger to certain species of animals and plants of economic importance, and that the results are often harmful rather than beneficial to agriculture. A writer (A. G. Reywall), in a recent issue of the Bulletin of the American Game Protective Association, asserts that the havoc wrought in some sections by drainage projects has been so great as to arouse indignation and resentment among people who realize that such areas have important functions in relation to agriculture and the general public welfare. The assumption that the area which it is proposed to drain will prove valuable agricultural land is not always warranted. This writer says:

> The rivers of the country, with their small tributaries, are the natural surface channels for carrying off surplus rainwater. A part of this water works through porous strata to varying depths and is discharged at the surface through springs which are the natural outlets of underground drainage. Small lakes and marsh areas are undoubtedly the fountain heads of great numbers of springs and wells which are so essential to the welfare of the community. These lake and marsh areas also act as great check-basins or natural reservoirs in which are held back enormous quantities of water resulting from heavy rains and rapidly melting snow, allowing it to flow off gradually and thus effectively lessening the danger of floods.

The whole country has been appalled by reports of disastrous floods in which great numbers of lives were lost and millions of dollars' worth of property destroyed. (As I write, the daily papers are telling of great floods in the Mississippi which have rendered more than 75,000 people homeless and destroyed millions of dollars' worth of property.) The destruction of the forests and the drainage of natural catch-basins, such as marsh areas, ponds and small lakes along the waterways, make such catastrophes inevitable, so that at times of unusual rainfall millions of tons of water sweep down the valleys, leaving fearful devastation behind.

In the State of New York it is now planned to establish numerous great reservoirs to hold back the flood water and to regulate the flow of streams that have their sources in the Adirondacks. It will cost millions of dollars to construct reservoirs to hold back water which could have been conserved naturally had the public interest been safeguarded as was easily possible.

Lake and marsh areas in their natural state have numerous important uses. In the first place, they conserve the run-off and establish a relatively uniform stream-flow, as I have already shown. In the second place, they provide resting, feeding, and breeding places for many species of waterfowl and other species of birds. They also provide appropriate environment for the muskrat and other species of fur-bearing animals. With proper management these marshes will yield annually many thousands of dollars in furs. In one marsh of 4,000 acres, in 1913, over 12,000 muskrats were taken valued at several thousand dollars. This marsh has since been drained, and the muskrats exterminated, but only about 100 acres of the area has been found fit for cultivation.

As a glaring example of serious mistakes in drainage operations, I may call attention to the Kankakee River in northwestern Indiana. This was until recently one of the most famous wildfowl shooting regions in America. The marsh through which the Kankakee flowed was some 50 miles long and five to 10 miles wide. Wild ducks and wild geese in enormous numbers annually visited these marshes, some to nest and rear their young, others to rest and feed while on their spring and fall migrations. Muskrats, mink, and other fur-bearers also were there in abundance, and the waters teemed with the finest of food and game fishes.

Recently these marshes have been drained and it has developed that the whole marsh area is sand with a coating of vegetable matter too thin to make a soil of any fertility. Several acres that were sown to rye produced absolutely nothing, and it is now generally recognized that nothing can be grown on this land.

Hundreds of thousands of dollars almost absolutely wasted in draining land which was found to possess very little value for agricultural purposes, and which will probably have to be irrigated at great expense to make it of any considerable value for any purpose. And we now have, or will have, a barren sand-dune region non-productive in any useful way, in place of a region which, before destroyed by short-sighted man, was one of the richest in America in wild fowl, fur-bearing animals and food and game fishes, to say nothing of its esthetic and recreational value.

This deplorable result could have been avoided if a careful soil-survey of the region had been made before deciding to drain the Kankakee marshes.

The State of Minnesota had a very similar experience, but a law has now been enacted to prevent any repetition of such mistakes by requiring the approval of the State Conservation Commission before any large areas may be drained.

It is frankly admitted, of course, that most of the swampland possesses agricultural value when drained, but much of it will have little or no such value. The point I wish to make is this: swamp lands, ponds and small lakes *as such* have uses and values that must not be ignored. I have noted that a proposition has been made recently to drain practically all of the thousands of small lakes in Wisconsin. Should this be done there will probably be more corn, cabbage and hogs in Wisconsin than now, but there will be less of beauty and the appreciation thereof.

Federal Protection of Migratory Birds

Researches by the Bureau of Biological Survey have demonstrated the importance to agriculture of our migratory birds. That insectivorous birds annually save millions of dollars to the farmer by destroying insects injurious to crops is no longer questioned. That millions of dollars of damage have been done to our forests by insects formerly kept under control by insectivorous birds is also well known. The esthetic value of our native birds must not be forgotten—the inspiration and stimulus which they give to the moral sense, the charm and beauty they give to nature and which enter so largely into the life of the people—these are values that can not be overestimated.

It is a great pleasure to call attention at this time to one illustration of intelligent appreciation of the value of our birds. If you will go down near the Temple here in Salt Lake City you will find a graceful Doric column 15 feet high. On the top of the column rests a granite sphere on which two gulls are in the act of lighting. If you read the inscription on the base you will learn that, in the spring of 1848, a terrible plague of crickets threatened total destruction to the growing crops which the Mormons had planted. Nothing which the people could do could stop the vast hordes of insects. Just when the situation seemed entirely hopeless, great numbers of gulls came over from their breeding grounds on Hat Island in the Lake and began devouring the crickets. In a short time the millions of crickets were destroyed and the crops were saved. The people, realizing that the gulls saved the day, expressed their gratitude in an unique and beautiful manner. And we have here to-day the

"Sea Gull Monument
Erected in Grateful Remembrance
of the Mercy of God to the
Mormon Pioneers."

Who can claim that the wild birds are not our friends, or that man is not sometimes appreciative!

Not until within recent years have many really effective steps been taken in this country to protect our birds. Only a few of the states had any protective laws whatever. Finally laws began to be enacted regarding game birds, but no attention was paid to the insectivorous and other non-game species. But the laws enacted by the various states were lacking in uniformity. Nearly all permitted spring shooting and market hunting, the open season was very long and the bag limit, if any, was ridiculously large.

THE LACEY LAW

One of the first Federal laws in the interest of bird protection was the Lacey Law enacted in 1909. The important provisions of this law are the ones regulating the shipment of game in interstate commerce and that regulating the importation of birds and mammals from foreign countries.

MIGRATORY-BIRD LAW OF 1913

Beginning with 1904, various attempts were made to secure Federal legislation for the protection of migratory birds, but it was not until 1913 that any results were secured. In that year the Federal Migratory-Bird Law was enacted. This law gave the Secretary of Agriculture power to fix close seasons during which it would be unlawful to capture or kill migratory birds. One of the most important regulations under this act was that prohibiting spring shooting. This regulation has proved of enormous benefit. The effect was almost instantaneous. Waterfowl and other migratory game birds at once showed decided increase, and many remained to breed where they had not bred for many years.

The question of the constitutionality of this law was raised but before it was passed on by the Supreme Court the law was repealed by the enactment of more effective legislation in 1918.

THE MIGRATORY-BIRD TREATY

On August 16, 1916, there was concluded at Washington between the United States and Great Britain a migratory-bird treaty for the more adequate protection of the migratory birds that visit the United States and Canada. This convention was ratified and became law December 7, 1916.

The making of this treaty is probably the most important single event that has ever occurred in the movement for the protection of migratory birds. Of a total of 768 species of birds recognized in the last (1910) edition of the A. O. U. Check-list of North American birds, 537 species are protected by this treaty; only about 220 species are not covered by the treaty; it is unfortunate that they, too, could not be properly included. Among those which are protected by the treaty are all the ducks, geese, swans, shore birds, plovers, snipe, cranes, and all migratory insectivorous birds. The treaty provides special protection for 5 years of wood ducks and eider ducks and for 10 years to the band-tailed pigeon, little brown crane and several other species. It makes spring shooting unlawful, and confines hunting to seasonable periods of not exceeding 3½ months for shore birds not given absolute protection, and other migratory game birds.

The Migratory-Bird Treaty Act

Although the treaty does not provide the machinery for its enforcement, it does provide that the High Contracting Powers shall enact the legislation necessary to insure its enforcement. Canada did so August 29, 1917, and the United States did likewise by passing the *Migratory-Bird Treaty Act* which was approved by the President July 3, 1918; and it has been well said that "the enactment of this legislation rounded out the most comprehensive and adequate scheme for the protection of birds ever put into effect."

Under this Act it is unlawful to hunt, capture, kill, possess, sell, purchase, ship or transport at any time or by any means any migratory bird included in the terms of the treaty except as permitted by regulations which the Secretary of Agriculture is authorized to make.

The constitutionality of the treaty and the treaty-act can not be questioned, for the Constitution provides that "all treaties made or which shall be made, * * * shall be the supreme law of the land; and the judges in every state shall be bound thereby, anything in the Constitution or laws of any state to the contrary notwithstanding."

The first regulations under the migratory-bird treaty act were prepared by the Secretary of Agriculture and approved by the President July 31, 1918. Certain amendments were adopted and made effective October 25, 1918.

The regulations are prepared by the Secretary of Agriculture, with the assistance of the Bureau of Biological Survey and an advisory board of 21 members representing all sections of the country. Regulations prepared with the great care which this implies are quite certain to give protection to the birds and at the same time meet the approval of the great body of sportsmen and others interested in bird protection.

The beneficent effects of this treaty were immediate. Reports showing a marked increase in ducks and other migratory game birds are coming in from all over the country. But as the ducks increase in numbers it becomes increasingly evident that a few things yet remain to be done before these birds will have entirely adequate protection and before the poor man can get that good from the increase which he ought to enjoy. Realizing this, Senator New of Indiana and Congressman Anthony of Kansas have each introduced bills known as The Federal Public Shooting Grounds and Bird Refuge Act.

This is a bill providing for the establishing of shooting grounds for the public, for establishing game refuges and breeding grounds, for protecting migratory birds, and requiring a Federal license to hunt them.

The important things which it is hoped will be accomplished by this bill if enacted into law are the following:

1. To establish refuges or sanctuaries where ducks, geese and other migratory game birds may stop to rest and feed undisturbed when on their way north in the spring and on their return south in the fall, and where any that may be inclined to do so may be induced to stop to breed and rear their young.
2. To provide for issuing a hunting license at the nominal cost of $1.00 to those who wish to hunt wildfowl.
3. To provide public hunting grounds where anyone with a Federal license may hunt.

The necessity for the sanctuaries becomes more and more apparent every day. The draining of the marshlands, ponds and small lakes in many states is rapidly rendering those regions unattractive and unsuited to waterfowl, with the result that the birds pass over without stopping in many places where they formerly tarried for a time in the spring, many of them even remaining to breed, and in the fall going on south without even stopping for a day.

By establishing sanctuaries many birds would tarry in the spring to rest and feed, some would remain to breed, and in the fall, they would again tarry to feed, and the sanctuaries would then become good shooting grounds.

The Biological Survey estimates that at least 5 million people in the United States take out hunting licenses each year. It is believed that at least one million would take out the Federal shooting license. Anyone wishing a license can obtain it at his postoffice. About a million dollars would thus be raised to be used as follows:

1. Not less than 45 per cent. for the purchase or rent of suitable land, waters, or land and waters, for use as public shooting grounds and migratory-bird refuges.
2. Not less than 45 per cent. for enforcing the provisions of

the migratory-bird treaty act and the Lacey Act, and for cooperation with local authorities in the protection of migratory birds.

3. Not more than 10 per cent. for expenses connected with issuing licenses, etc.

One of the excellent features of this law, if it becomes a law, is that all expenses connected therewith will be paid out of the fund resulting from the sale of hunting licenses. The expense of enforcing the Lacey Act and the Migratory-Bird Treaty Act will also come out of this fund. Congress will not need to appropriate any money at all.

Another excellent feature is that it will afford the poor man an opportunity to hunt waterfowl. Under present conditions practically all the good shooting grounds are owned or controlled by shooting clubs to which only men of means can afford to belong. The proposed law will give the poor man an equal chance with the rich man. The cost of the license is nominal; anyone who cares to hunt at all can afford to pay $1.00 for a shooting license.

It has been estimated that there are over 60,000,000 acres of government swamp land in the United States, much of which, even if drained, would have little or no agricultural value. Numerous wild fowl sanctuaries and public shooting grounds could be established in these swamp lands which would prove of inestimable benefit to migratory birds and at the same time afford splendid sport to thousands of people who enjoy a few days shooting each season. I understand that there is at the mouth of the Bear River in this state a large area of swamp land all ready to be made into a large refuge, and I further understand that the Governor and the people of Utah are strongly in favor of having this tract made into a Federal bird refuge and public shooting ground.

This is fine. There are doubtless many similar areas in the state, as there are in practically every state in the Union.

With the establishment of sanctuaries and public shooting grounds such as these in various parts of the country, the safety and conservation of our migratory game birds is assured.

Some of our migratory birds do not belong with the waterfowl. The first of these is the passenger pigeon, a species which 100 years ago was found in the eastern United States in incredible millions but which in the last 50 years decreased to total extinction. The last known living individual died September 1, 1914, in the Zoological Park at Cincinnati where it had been in captivity 29 years. The species is now believed extinct. It is barely possible a few individuals remain in some of our more remote heavy forests, but this is highly improbable. If, perchance, any should remain, they will receive absolute protection under the migratory-bird treaty act, and in time the species may be reestablished.

The band-tailed pigeon, a related species, is not rare in several of the Pacific Coast states. It will receive absolute protection for 10 years. At the end of that period, this interesting and beautiful game bird will doubtless be abundant again.

Still another related species is our common turtle dove, a species of wide distribution, common nearly everywhere, but abundant in nearly all our western states. The turtle dove is very tolerant of civilization and thrives well on the farms. To maintain it in safe numbers it is only necessary to have not too long an open season, a bag limit not too large, and to give rigid protection to their nests and eggs.

Very unfortunately, that great group of gallinaceous birds, the wild turkeys, quail, pheasants, grouse, ptarmigan, prairie chickens and sage hens, are not to be classed as migratory birds and therefore do not come under the protection of the migratory-bird treaty. There are about 50 species and subspecies of them, among which are some of the greatest game birds in the world. Many of them occurred in incredible numbers in the early days, while now probably not one is found in anything like its original abundance.

The wild turkey was doubtless the greatest game bird the world has even known. Up to the close of the Civil War this wonderful bird was abundant from Maryland westward to Minnesota and eastern Kansas and south to Florida and Texas and through New Mexico into Arizona. In the Upper Mississippi Valley it was common in all suitable places as late as 1870; in a few favored localities small flocks survived into the early eighties. In certain localities in southern Missouri, Oklahoma, Texas and Florida a few remain to this day; and it is said a few may be seen in Virginia within sight of the dome of the Capitol at Washington. In New Mexico and Arizona considerable numbers still remain.

The nature of the wild turkey is such as apparently makes it intolerant of civilization; it is not necessarily so. While it is a bird that under persecution requires heavy cover, it thrives well in open woods, especially of oak and beech if not too persistently molested. There still remain in many of the states thousands of acres of excellent cover where the species could doubtless maintain itself if once reestablished and proper protective laws and regulations provided.

What I have said regarding the wild turkey can be said of most of the species of gallinaceous birds. Most of them were once vastly more abundant than they now are and many of them must be classed among the vanishing game birds unless something is done soon for their preservation. The ruffed grouse and all the quail, the prairie chicken and the sage hen, are each, in varying degrees, seriously depleted and in danger of actual extermination. While much has already been done to save the bob-white and other quail, and perhaps a few others, even they are doomed unless a great deal more is done.

The natural cover along the stream courses, on the hillsides, in the glens and dells and in and about the marshes and swamps affords ideal environment for the ruffed grouse. Every effort should be made not only to preserve every existing acre of this cover, but the cover should be improved whenever possible, and new acreage should be added from time to time by encouraging wild growth upon otherwise useless land. On many farms there are small waste areas which, with a little carefully directed neglect, can be converted into copses that would serve admirably for birds of this kind.

Cover that is good for ruffed grouse is also good for the bob-white. Even a very small thicket will furnish ideal cover for a flock of bob-whites. A number of such thickets judiciously located about the farm would do wonders in keeping it well supplied with these birds.

The prairie chicken, like the bob-white, is a species tolerant of civilization. Fields of grain such as wheat and corn are just to their liking and the wastage in the fields would assure an abundant food supply throughout the winter and any periods of food scarcity that might come. All that is necessary is a few waste places on the farm covered with copsy thickets and tall grass.

Of course their nests must be protected; and this leads me to make a plea for the unkempt fence corner, where the grass and weeds are allowed to grow and the briars and brush to run riot over the ground and fence. True, this is not so possible now with our wire fences as it was in the good old days of the picturesque old Virginia stake-and-rider rail fence—more's the pity. Such cover as the fence rows of this kind would afford would prove invaluable to prairie chickens and quail by supplying protection not only to the birds themselves but also to their nests.

The sage hen is one of our most picturesque and most valuable game birds. In size it is inferior only to the wild turkey. On our western sage-brush plains it formerly occurred in countless numbers. Its natural habitat was the almost valueless sage-brush country where agriculture is in most places impossible, although it has a slight value for grazing. And it is this that is exterminating the sage hen. Flocks of sheep ranging over the sage-brush plains during the breeding season of the sage hen are almost certain to destroy every nest which the sheep herders had not already robbed. Regions in which sage hens were common only a few years ago are now without a single bird. Unless the Federal government and the states take action very soon the sage hen is doomed.

The woodcock is another of our splendid but vanishing game birds. Perhaps no other game bird has been more highly esteemed. Feeding, as it does, almost entirely on angleworms and other food which it obtains by prodding in the soft ground of the borders of ponds, springs and marshes, it is easy to see how disastrous to this bird the draining of our marshlands must inevitably prove to be. Moreover, it is a delicate bird, easily influenced by sudden freezes which make it difficult for it to obtain food.

Much can be done toward saving the woodcock by leaving undrained all marshland, ponds and springy hillsides that are not really needed for agricultural purposes.

The jacksnipe is very similar to the woodcock in its habits, game qualities and danger of extermination, and the measures that would be taken to save the one would apply to the other.

Of the scores of species of our less important game birds I need say little, except that they must not be forgotten and that measures taken to conserve the important species will ordinarily apply to the less important ones as well.

Game Mammals

Excepting perhaps Africa, no other country in the world ever equaled North America in the richness of its game mammals, marvelously rich not only in species and subspecies but also in number of individuals. Of the more than 300 species that might be mentioned, it must suffice to speak of only a few, for the story of former marvelous abundance, wasteful killing without thought for the future, and inevitable extermination or serious depletion applies to all.

The three species of grizzly bears that occupied such a picturesque place in the early history of California are all extinct; it is believed that not a single individual remains alive anywhere to-day. Many of the others, while not actually extinct as species, have been actually exterminated over a large portion of the country over which they originally ranged. Among these are several species of deer, the buffalo, moose, elk, antelope, various bears, foxes and gray squirrels. All that we have left now are isolated pitiful remnants of the vast numbers with which our older people were once so familiar. Many of them are so rare now that we can truthfully say they are, indeed, commercially extinct, and can never be restored.

Of course, it is quite true that serious depletion, even commercial extinction, of some of these species, such as the buffalo, was inevitable. On the other hand, it ought to be possible to reestablish many of these species and bring them back to something like their former abundance. The changes in environment incident to the development of the country agriculturally and otherwise should not necessarily prove fatal to them. Moose, deer, bear, foxes, squirrels, beaver and muskrats could doubtless be maintained indefinitely in large numbers in many parts of their original habitat, if given that protection which can easily be given, and at the same time splendid productive hunting could be had. This would apply to Maine, the Adirondacks and other parts of New York, many parts of Pennsylvania, Michigan, Wisconsin and Minnesota. And the same could no doubt be done in all the states along our northern boundary and in all the Pacific Coast states. The muskrat should still find a congenial home in all parts of the United States east of the Sierras wherever swamp land, marshes, permanent ponds and small lakes are found; provided, always, that such of these favorable localities as can not be made agriculturally valuable are left undisturbed.

It is true that some of our most interesting game animals are predatory, not only upon other wild animals such as deer, antelope, elk and ground-nesting birds, but also are destructive to domestic stock. Among the worst are the wolves, coyotes, Canada lynxes and mountain lions. The United States Bureau of Biological Survey has been waging a very effective campaign against these predatory animals. When the Bureau began its campaign a few years ago it was estimated that these animals were causing a loss of more than $20,000,000 annually. Expert hunters and trappers were employed by the Bureau in cooperation with the states and with other interested agencies with the result that more than 50,000 predatory animals were destroyed in one year. If these animals had not been killed they would have destroyed fully $3,000,000 worth of domestic live stock to say nothing of the great numbers of deer and other valuable game mammals and birds they would have destroyed.

One sheep man wrote to the Survey that its predatory-animal hunters had saved his flocks from the loss of at least 1,000 lambs in one year. There are among predatory animals just as there are among dogs individuals that have acquired the sheep-killing or calf-killing habit, and the expert hunters make special and usually successful efforts to get them. A noted case was that of the notorious Custer wolf in Wyoming, which was believed to have killed $25,000 worth of cattle in a period of seven years. So crafty was this old wolf that he eluded all efforts to capture or kill him in spite of the fact that a bounty of $500 was placed on his head. But last year he met his fate through the skill and marksmanship of a bureau hunter.

Another illustration: a pack of eight wolves that had inflicted losses totaling $20,000 on calves, pigs and sheep about the Arkansas National Forest were all destroyed by a single bureau hunter in a period of three weeks. Still another old renegade wolf reported to have destroyed $6,000 worth of cattle on a single ranch besides making heavy inroads on other ranches, including nine head of yearling cattle in the last six weeks of his life, finally fell a victim to a skillfully placed trap of a bureau hunter.

The California Fish and Game Commission estimates that a mountain lion will kill on an average one deer a week throughout the year, and that there are about 600 lions in the state. At 52 deer each they would kill about 30,000 deer annually, which is about twice the number killed by all hunters in the state. From this it appears that the mountain lion should receive no protection.

Fortunately, the great majority of our important game mammals are not predaceous at all, or in only a slight degree. Fortunately also, some of the species are being conserved fairly well in some parts of their range. This is especially true of the deer.

The federal and state governments have established a number of game preserves, some of them under fence. The principal game animals in these reservations are buffalo, elk and antelope. All are showing satisfactory increase each year, and there is every reason to believe that these herds will continue to thrive.

The outlook for the wild elk, antelope, mountain sheep and mountain goats is not so encouraging.

Of the several species of elk the one commonly known as the California Valley elk or Tule elk is in most serious danger of extermination. This species formerly ranged over the San Joaquin Valley in great numbers. About 50 years ago it was threatened with extermination, but it was saved through the active interest of Henry Miller, head of the great cattle company of Miller & Lux.

In 1914 the only remaining herd of this species ranged over the Buttonwillow ranch of Miller & Lux in Kern County. In that year and in 1915 the California Academy of Sciences with the cooperation of Miller & Lux distributed 150 of these elk to various federal, state and private parks in the state, and it is gratifying to know that in most cases the animals have increased in numbers, and that these nuclei of new herds are doing well.

But the original herd in Kern County is in serious danger. Although it is unlawful to kill any elk in California, the warden service is poor and the animals are not receiving the protection they must have if the herd is to be saved. In my judgment the species is doomed unless more adequate measures for their protection be taken soon.

Probably the best thing to do would be to enclose with suitable fence not less than 3 or 4 square miles of land in the region they inhabit. It would be easy to do this. A strip of land one mile wide, beginning up toward the foothills where the elk habitually stay and extending down into the valley about four miles so as to include about 300 acres of arable land on which alfalfa can be grown to supply feed in the dry season, is all that is necessary. The sale of surplus males and other animals from time to time to zoological parks, etc., would render the herd self-supporting.

Fur-Bearing Animals

Few of us realize what an asset the various states have in their fur-bearing animals. America's list of fur-bearers is a long one; the total number of species and subspecies whose pelts have considerable commercial value as fur is not fewer than one hundred. Among those of most importance may be mentioned the beaver, otter, fisher, mink, fur seal, sea otter, marten, muskrat, skunk, raccoon, weasel, fox, lynx, bobcat, wolf, coyote, and bear. Several of these are represented in the United States by two or more species or subspecies.

Not until recently were several of these species in much demand, but now the lowly muskrat and the much-despised skunk have come into their own. They are now among the most popular and high-priced furs.

As Dr. Dearborn, of the Bureau of Biological Survey, has well said, the demand for fur has existed since primitive man first sought skins to shield his naked body from the cold. This demand is fundamental and will endure while man inhabits the earth and furs are to be had. Its strength can be judged by the volume of trade it supports.

The fact that many of the fur-bearers are predaceous animals complicates the problem. However valuable the fur of an animal may be, if the habits of that animal be such as render it an enemy of domestic stock or useful game animals, its conservation is not an unmixed blessing. Such animals must therefore receive special treatment. Fortunately, the majority of our fur-bearers are destructive to other useful species or interests only in a small degree or not at all, and it is possible to provide laws and regulations for the conservation and proper utilization that will render their preservation highly desirable.

Some of the more important species are already seriously depleted; some have been even exterminated in many regions where they were formerly abundant. The beaver, marten and mink may be mentioned as examples of this class. Their extermination has been brought about chiefly by excessive trapping and changes in the character of their environment. It is believed that most of those which have been greatly depleted can be restored and maintained in reasonable abundance if proper laws and regulations be provided for their protection.

The essential principles of the protection of fur-bearing animals are few and easily understood. In the first place, there should be a permanent closed season for a period of years in any region in which the species has become so seriously depleted as to be in danger of extermination. In the second place, no animal should be killed during the breeding season; that is, when its death would mean the starvation of the young; and fur-bearing animals should be killed only when their fur is prime.

Perhaps the most important of these is that relating to unprime skins. It has been estimated that the value of the furs that come to the markets is reduced fully 25 per cent. by the large number of unprime skins. Killing fur-bearers in their breeding season before the family break-up and dispersal in the fall is a wasteful practice. Uniform laws throughout the United States prohibiting traffic in unprime skins should be enacted.

Every trapper or hunter of fur-bearing animals should be required to secure a license good for one year, and he should be required to report at the end of the season the number of animals of each species taken. This would furnish data essential to determining the value and extent of the fur resources of the state and the relative abundance of the different species. Such statistics would inspire people with a desire and determination to make fur a regular and valuable farm and forest crop.

Under natural conditions or such as can be easily maintained, one or more species of fur bearers may be found in some numbers on many of the farms of the country. Hunting or trapping such animals is a recreation, sport or avocation that appeals strongly to most country boys. If they do their trapping intelligently, they will not only profit greatly by the sport it affords but will also add materially to the income from the farm.

FUR-FARMING

Recently the possibilities of fur-farming have begun to attract wide attention.

Figures compiled by the Bureau of Biological Survey show that there are fur farms in at least 25 states. There are about 500 ranchers raising silver foxes, with 12,000 to 15,000 foxes in captivity.

Other species on the fur-farms are skunk, raccoon, mink, opossum, marten, muskrat, squirrel and beaver. The business, when intelligently conducted, is a fascinating and profitable one and can be carried on successfully in almost any of the states.

The state agricultural colleges and experiment stations, and state game and conservation commissions should encourage fur-farming. The United States Bureau of Biological Survey will be glad to give directions and suggestions as to the methods of fur-farming that one must follow to insure success.

In those parts of the country where there are small lakes or ponds surrounded by marshland opportunities for fur-farming are excellent. Usually in each marsh there will be found from a few to many muskrats. With proper care and management, the number can usually be greatly increased and maintained, at the same time permitting a considerable annual catch. And now that the muskrat is so popular as a fur, under the trade name of "Paris Seal," muskrat farming will prove a very profitable side issue on the farm.

Marine Mammals

There remains one important natural resource in which this country is vitally interested, the conservation of which has received practically no attention; and this appears all the more astonishing when we realize that in this natural resource are found not only the largest animals in the world but a number of the most valuable. I refer to the marine mammals—the whales, fur seals, walrus, sea lions, sea otters, porpoises, the elephant seal and other species whose home is in the sea. And it is a curious fact that we know less about these great and interesting animals of the sea than we do of any other group of useful animals.

We know a good deal about the Alaska fur seal; a little is known about the Russian fur seal and the Japanese fur seal, but scarcely anything about the several species in southern waters.

Some years ago, a species of fur seal was not uncommon about the islands off the coast of California and Lower California. In the early part of the last century it was very abundant on the Farallons just off the Golden Gate. One party that visited those islands in 1808 took in two seasons 130,000 fur seals and many sea otters. Another party took 33,740 fur seals in 1810 and 39,555 in 1811. The catch in four years was more than 200,000. It has been thought this species became extinct about 30 years ago. However, the capture of a living specimen in March (1922) near San Diego shows that it is not yet extinct; it further emphasizes our lack of knowledge of the distribution and abundance of our marine mammals. It also suggests the possibility of reestablishing fur-seal rookeries on the Farallons and other islands off the coast of California and Mexico. What a fine achievement that would be!

We know only in a general way what species of marine mammals there really are in the North Pacific; but it is safe to say the mammalian fauna of the Pacific is the richest in the world. There are probably not fewer than 50 species in the North Pacific and the total number in the entire Pacific is doubtless much greater; but we do not really know. In the North Pacific we may recognize 14 kinds of whales, 12 porpoises, killers, dolphins, etc., one bear, two sea otters, four fur seals, and a dozen hair seals, harbor seals and sea lions.

With few exceptions practically nothing is definitely and authoritatively known of the life history of these animals. Their food and feeding habits, distribution, migrations, breeding seasons and places—these are but a few of the many things in the life history of these species about which we would like to know and which we must know before final measures for their protection can be intelligently formulated.

The commercial fisheries of the North Pacific can be properly understood and regulated only in the light of pretty full knowledge of the whales, seals and other marine mammals. We must know just what relation the whales, sea lions, harbor seals and porpoises sustain to the salmon, sardine, herring, cod and other food-fishes of our coast. The relation of the California sea lion to the salmon fisheries has long been a matter of dispute. Conclusive and convincing study of the question has never been made, and no one is in a position to say just what laws and regulations should be enacted regarding those species. The same is true of the whales. Our knowledge of their abundance, distribution and feeding habits is very incomplete.

Not long ago the Moss Landing Whaling Station of the California Sea Products Company reported they had found in the stomach of one humpback whale 1,500 to 3,000 pounds of sardines, besides a miscellaneous lot of smelt, anchovies, shrimp and squid! In the stomach of a sperm whale were found a 10-foot shark, a piece of fur-seal skin and a bunch of fishhooks! Some time ago two killer-whales or Orcas were examined at the Pribilof Islands; the stomach of one contained 18 fur seals, the other 24. At current prices of fur-seal skins those meals cost about $1,000 to $1,500 each!

These illustrations are sufficient to show that these species bear a very important relation to the sardine, fur seal and other commercial fisheries. And they further show the necessity of a thorough study of the relation of these and other marine mammals to the fisheries.

The Moss Landing Whaling Station furnishes exceptional facilities for a study of the whales. The California Sea Products Company which owns and operates this station has very kindly kept certain records, at the writer's suggestion, during the past four years. These records include the following data for each whale taken: species, sex, length, weight, stomach contents, date when taken, place where taken, and size of embryo, if any.

The total number of whales taken by this company on the coast of California from January 16, 1919, to May 3, 1922, was 832. Seven different species were represented, as follows: bottlenose 1, sei 1, California gray 1, sperm 5, sulphur-bottom 5, finback 33, and humpback 781; total 832.

These figures are of value in that they show the species of whales that now occur on the coast of California and the relative abundance of the different species. It is seen that only one—the humpback—is at all common. The scarcity of the others is significant; indeed, all but the humpback are already commercially extinct. Only the humpback remains in sufficient abundance to justify the establishment of a whale fishery on this coast.

In 1853 Captain Scammon estimated that fully 30,000 California gray whales visited the California coast annually. The small catch of that species shows clearly that it has been almost exterminated on the California coast. It is evident that the humpback whale also will soon be as seriously depleted unless effective measures be taken soon for its protection.

While the whales are the largest animals in the Pacific, they are by no means the only ones that are in grave danger of extermination and that need protection.

In the early days the southern sea otter was common on the California coast and about the islands off the coast of Lower California. According to old Spanish records 9,729 sea otters had been taken on the California coast prior to 1790. The O'Cain expedition in 1803-4 took 1,100, the Winship expedition took 5,000 in 1805-6, and a party under a man named Campbell took 1,230, all on the California coast. From these figures it is evident that the sea otter was formerly very abundant on the California coast and that the environment was a very favorable one. It seems that it should be possible to reestablish the sea otter in those waters. While none has been seen for several years, there is good reason to believe a few still survive.

The Guadalupe fur seal was at one time common about certain islands off Lower California, but none was seen since 1892 until in March of this year, when one was captured near San Diego. This would indicate that there still exists a remnant of a herd that can again be built into one of commercial importance.

Up to a few years ago the great elephant seal existed in considerable numbers at Guadalupe Island off Lower California. It is now almost extinct; only prompt action can save it. On the same coast and in the Gulf of California sea turtles were very abundant not long ago; now they are said to be very rare.

Several other species threatened with early extermination could be named, but these must suffice.

The Alaskan, Russian and Japanese fur-seal herds are now fairly safe, thanks to the International Fur-seal Treaty entered into in 1911 by the United States, Great Britain, Russia and Japan. The northern sea otter is also protected by the same treaty. While that treaty has some serious defects it is believed they can be corrected in 1926 when an opportunity to do so will be afforded. But this treaty, unfortunately, does not cover whales, walrus, sea lions, southern sea otter, elephant seal or any of the southern fur seals.

It is perfectly lawful for anybody to kill any of these animals anywhere on the high seas. No country has jurisdiction beyond the 3-mile limit. Only by international agreement can they receive the protection necessary for their preservation and conservation.

The United States should take the initiative in bringing about an international treaty for the protection of the marine mammals of the Pacific. The principal countries concerned are the United States, Japan, China, Russia, Great Britain, Mexico and Chile, but every country at all interested in the Pacific should be invited to join in the treaty.

At the meeting of this association held in Berkeley last year a "Committee on the Conservation of Marine Life of the Pacific" was appointed. This committee is now functioning under the Committee on Pacific Investigations of the Division of Foreign Relations of the National Research Council. The committee is endeavoring to develop an interest on the part of the public in conservation of our natural resources, particularly those of the sea. It is endeavoring to interest the zoologists of the countries bordering on the Pacific in the wonderful animal life of that great ocean. It is making investigations and assembling data regarding the former abundance of various species, their present condition, and the causes which brought about the change.

In its efforts toward creating a strong public sentiment for conservation, the committee is trying to interest boards of trade, chambers of commerce, fish commissions, scientific societies, newspapers, women's clubs, and officials of educational institutions including colleges, normal schools, and public schools. It hopes to make use of the public press and public lectures that the people may learn something about the wonderful resources of the sea which we, through ignorance, indifference and greed, are permitting to be seriously if not fatally depleted. The committee plans to form an association or organization to be known by some such name as "The Associated Societies for the Conservation of Marine Life of the Pacific," and it is hoped to bring into this association as many as possible of the naturalists, educational institutions, chambers of commerce, boards of trade, fish and game commissions, fishery companies and other interested units found in the various countries bordering on the Pacific.

It is hoped that public interest in the conservation problem of the Pacific will in the near future be developed to such an extent as will result in an international treaty broad enough in its scope to cover not only all the marine mammals but also the fishes, birds, and reptiles of the Pacific Ocean.

That our game mammals and birds, our fur-bearing animals and our marine mammals are among our most valuable natural resources is not fully realized by many of us. A few figures, however, will readily convince us that we have in these animals natural resources almost fabulous in their money value. Take for example the deer: the number of deer killed in 1915 by hunters in 36 states was 75,000. At 150 pounds each these would weigh 11,250,000 pounds, worth 20 cents a pound, or $2,250,000. It is claimed that the annual kill of deer in the entire United States could safely be put at 100,000, worth $3,000.000. Rabbits are a very valuable food asset. In 1918, 465,000 were killed in the State of New York alone. In 1919, 2,719,879 were killed in Pennsylvania. In 1920, 293,665 were killed in Virginia. At 20 cents apiece (a very conservative estimate) these rabbits had a money value of $695,710, which is no small item in the food supply of the country. And this embraces the catch in only three states. In the whole United States it must have been many times as great.

Now let us consider the game birds. In 1920 hunters in Minnesota killed 2,083,991 ducks, geese and other game birds, worth at least $1,000,000. In the same year there were killed in Virginia 187,582 quail, pheasants, turkeys, doves and woodcock worth more than $110,000. The take of game animals in the same period was valued at $350,000, while in New York the game mammals and birds taken in the same period numbered 1,526,960 valued at $3,239,277. From these figures it is believed that the game mammals, fur-bearing animals, and game birds of the United States yield to our people not less than the stupendous amount of $100,000,000 annually. Surely the conservation of such valuable resources as these is well worth while.

I should like to say something about the fisheries and the fur seal, those wonderful resources in which I have been most interested for many years, but time does not permit.

I can only say that they, too, must receive our most thoughtful and serious consideration if they are to be rehabilitated and maintained in anything like their former productiveness. No nation can grow populous and great and long survive which, through lack of vision, continues to destroy those very resources which have made it great.